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(54) TRACK SANDING METHOD AND DEVICE

(71) We, KNORR-BREMSE GmbH, Moosacher Str. 80, D-8000 Munchen 40, Federal Republic of Germany, and a German Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method and device for sanding the track in advance of a wheel of a vehicle running on the track.

Known sand dosing devices have already been employed on steam locomotives. There, they were intended, by sanding, to help to prevent mainly slip on starting and therewith also possible damage to the driving mechanism, but also in the event of braking flat locations at the wheels were to be prevented. On the steam locomotives, the sanding devices were protected in the travel direction, accommodated in the vicinity of the steam boiler, thus profiting from the heat thereof which diminished the moisture content both of the sand and also of the pressure air.

On modern motor vehicles, the sanding devices are generally disposed in the bogies, thus being completely exposed to air resistance in both directions of travel, with vigorously and suddenly changing temperatures, humidities and dynamic pressures of the travel air-stream. Additionally, at the present day the demands made on sanding devices are very much greater than they formerly were, because modern high-speed rail vehicles can only be economically fully employed if their traction and braking capacities (which are very much higher relative to what was formerly the case) can be transferred to the rail. This is, however, possible only in the event of adhesion values between wheel and rail which on the average are extremely high. Since this, however, as hitherto fluctuates and as a function of weather conditions may suddenly greatly decrease, it must therefore be increased more frequently, more rapidly and more reliably than hitherto by sanding. This may be necessary for example during a braking action from 200 km/h continuously or also section-wise and several times.

Such requirements cannot, however, be satisfied by hitherto known installations because they:

— do not function adequately free from disturbance and reliably,

— do not dose quantities corresponding to the sand requirement and do not dose them precisely,

— are not able to supply the large requirement of sand at high velocities.

These disadvantages of present-day dosing devices depend on their design, since they are not suitable for the changing properties of the sand and for present-day requirements and the sand properties of the braking sand are not taken into consideration.

A braking sand which is frequently employed comprises 5-degrees-hard sand which is generally sharp-edged, being therefore generally broken sand having a grain size of mainly 0.5 to 1.6 mm.

In a loose heap, this sand has in the dry condition a porosity of 0.4. That means that approximately 40% of the bulk-heap volume consists of air. It surrounds the sand grains and therefore to a considerable extent determines the sand properties necessary here. Due to jarring during travel, it is true that the porosity does decrease, but it can be re-increased almost as much as it desired, under slight pressure due to finely-divided air, since an adequate number of air ducts are free between the sand grains.

The water content of the sand is due to supplying and transport in the tank waggon and fluid-tight small packing constricted to such an extent that it no longer requires to be pre-dried in heating installations. As a rule, the water content of the brake sand in the supply containers of the sand installations of the vehicles is about 1 per cent by weight, i.e. approximately 2 volume per cent, but is frequently increased above all as a function of weather.

Such water is produced in consequence

of frequent condensation of the moisture of the varying air content at the walls of the only partially filled supply containers which are not thermally insulated and not sealed fluid-tight, and which are subjected to the temperatures, frequently varying by 20°C, of the travel air-stream.

These small water quantities of only approximately 2 volume per cent of the sand can it is true not substantially vary the porosity of the sand and cannot clog the air ducts between the wall grains, but they coat in particular the smooth rupture faces of the sand grains with adhesion liquid, so that they adhere firmly together. Due to relatively long jarring during travel, more and more such rupture faces adhere to each other. Thereby, the inner friction of the sand and its angle of repose are greatly increased.

According to test results, the flow capacity of the dry sand diminishes from 100% to 70% even with 0.5 per cent by weight of water, in the case of 1% water it already decreases to 40% and in the case of 1.5% water content the sand already ceases to flow. Its adhesion forces are therefore already greater than the mass forces for the replenishing flow of dry sand.

However, the adhesion forces prevent both the necessary uniform replenishing flow of the sand and also precise dosing. Hitherto, the adhering sand grains have been suddenly separated from their adhesion union and pushed away solely by air jets, with which arrangement also agglomerations are torn off in their entirety. Although for this purpose strong air-stream forces and much air are employed, uniform and precise dosing of such sand cannot be achieved in this manner. Known dosing devices are operated with pressure air of 8 bar directly from the main air container. Their nozzle cross-sections are generally selected for a rated quantity of 1 l sand per min., i.e. approximately 1400 gr. For other rated quantities, the nozzle cross-sections must be changed. Quantity ratios of at maximum 1 : 2.5 only are achievable. In the case of small quantities the known dosing devices dose generally up to 50% in deviation from the rated quantities and do so also chronologically inaccurately.

Apart from inaccuracies, the known devices therefore dose constant quantities per minute, i.e. time-proportional quantities. This does not correspond to the obvious requirement to sand uniformly the travel path, i.e. preferably always to supply equal quantities of sand per metre of travel path.

Time-proportional sanding has, due to the increase of the maximum velocity of motor traction vehicles and trains, become progressively more disadvantageous in recent years.

If at 100 km/h for example approximately 2 cm^3 sand per metre of braking path are sanded, then at 200 km/h only 1 cm^3/m, but at 10 km/h 20 cm^3 per m sanded. Thus, the quantities fluctuate in the ratio of 1 : 20.

In the event of slip in consequence of inadequate sand at commencement of a brake path, the brake path is considerably lengthened, due to excessive sand at the brake path end, which the rail travel surface hardly takes up, points and track signals are disturbed.

For 2 cm^3 of sand per m of travel path at 200 km/h, however, for a short period of time 3.2 l of sand/min., i.e. 3.2 times as much as hitherto, but at 10 km/h only 0.16 l/min., i.e. only approximately 1/6 of the hitherto rated quantity are required.

For a brake path of 300 km/h, the quantities in a braking time of approximately 60 s must fall from approximately 5 l/min. to 0.16 l/min., if a plurality of installations is sanded one after the other, then the smallest sand quantities must also decrease with the velocity. Thus, path-proportional sanding involves velocity-dependent sand quantity control with a quantity dosing width which is 10 times as large than in the case of hitherto installations. Such large and small quantities, approximately in a zone of 0.02 kg/30 s up to maximum values of over 5 kg/30 s, it had hitherto, however, not proved possible to dose with adequate accuracy. The quantity variation must not take place continuously, adequate may be a multi-stage adaptation to the desired quantity curve to correspond to the velocity characteristic.

According to the present invention has been developed primarily though not exclusively, with a view to providing a sanding process of the type mentioned at the outset and a sanding device for the carrying into effect of the process, whereby more reliably and precisely much larger and smaller sand quantities can be dosed, the sanding device being suitable in particular for path-proportional sanding, i.e. for velocity-dependent quantity control.

The sanding device is to replace the hithto known installations at motor traction vehicles which are actuated mechanically by the locomotive driver or electrically against slip of the motor traction vehicle on starting, shunting, and on ascent slopes and in the event of sliding of the motor traction vehicle and of the train on braking being effected. The sanding device is, however, also to be pre-controllable by velocity signals and also due to slip signals. In addition, the sanding device is also to be employed at travel train compartments for the sanding of long trains and,

there, to be pre-controlled by velocity signals and triggered as a function of slip. Finally, the sanding device according to the invention is to be suitable, readily and in simple manner, for changing-over the conventional sanding devices.

Tests effected by the inventor showed that the inner friction of the sand can be greatly reduced due to enlargement of its porosity by air, i.e. in cases when the sand has small water contents up to 2 volume per cent. Since the air ducts between the sand grains are, in this case, still to a considerable extent free, they can, by finely-divided air at low pressure, be gradually considerably widened and increased, whereby the sand porosity is for a period of time increased far beyond the normal dimension. Due to the greater degree of movability of most of the sand grains thereby achieved, the grain faces which still adhere are released from each other and additionally gradually become dried.

As tests have shown, therefore, sand with so small a water content need not be specially pre-dried, it becomes solely due to larger admixture of air, substantially as flowable as dry sand. Frozen adhesion liquid can, via the sand ducts, with hot air, rapidly be melted and also dried.

The present invention has been derived from the realisation that fine-grain bulk materials can be delivered and controlled, to a considerable extent independent of their surface character, due to adequate mixing with air such as air-streams, and that due to a higher degree of porosity than the average, in a dry heap, it becomes possible to eliminate higher inner sand friction in consequence of alternating grain sizes, and the adhesion liquid.

The generally larger air quantity for dosing the sand must therefore correspond to the greatly varying sand requirement. The required air quantity for increasing the sand porosity is, with this arrangement, relatively small and requires only to be slightly controlled.

According to one aspect the invention provides a method of sanding a track, via a sanding tube arranged to direct sand onto the track in advance of a vehicle wheel, by means of a sanding device and sand-supply container controlled from the vehicle;

in which a controlled quantity of a main supply of air is supplied to the container so as to convey a controllable sand-air mixture from the container to the sanding tube;

a subsidiary flow of air is caused to flow through substantially the entire content of the sand in the container in co-current or counter current relation to the flow of sand towards the entrance to the sanding tube, and generates a controlled super-atmospheric pressure in the container;

after a passage of the subsidiary flow of air through the sand in the container, the subsidiary flow is caused to enter the sanding tube;

and the rate of flow of air in the main flow and in the subsidiary flow are controlled as a function of the required rate of supply of sand to the track.

According to a further aspect the invention provides a sanding device for sanding a track in advance of a wheel of a vehicle running on the track, the device comprising:

a pressurisable sand supply container;

a sanding tube having an inlet communicating with the interior of the container to receive a supply of an air-sand mixture therefrom;

a pressure control system including an air pressure line communicating with the interior of the sand container;

means for defining a main path of airflow from said pressure line to said inlet of the sanding tube so as to deliver a sand-air mixture to said inlet;

means for defining a subsidiary path of air-flow through substantially the entire content of sand in the container, in use, in co-current or counter current relation to the general direction of flow of sand towards the inlet of the standing tube, thereby to render flowable the sand in the container and to generate super-atmospheric pressure therein;

and means for controlling the rate of flow of air along said main path and along said subsidiary path as a function of the required rate of deposition of sand on the track via the sanding tube.

Sanding devices according to the invention are described in greater detail and discussed with reference to three examples of embodiment. In the associated drawings, the examples of embodiment are shown purely diagrammatically and considerably simplified. In the said drawings:

Figure 1 shows a first example of embodiment of a sanding device according to the invention,

Figure 2 shows a second example of embodiment of such a sanding device, and

Figure 3 shows a third example of embodiment.

Referring to Figure 1, a sand supply container of a sanding device according to the invention is designated 1. The container 1 has at its upper end a central aperture 2 for replenishment with sand. The aperture 2 is adapted to be closed to a considerable extent fluid-tight by a cover 3. The container has at its lower end an outflow end 4 which tapers funnel-wise and to which a dosing device 5 is flanged.

The container 1 with the aperture 2

closable by the cover 3 and the funnel-form outflow end 4 is known per se and is also already used on known sanding devices.

The dosing device 5 flanged to the container 1 comprises a pot-form dosing container 6. In the dosing container 6, there projects through the base of the dosing container a sand out-flow tube 7 the upper end 8 of which projects under a fixed bell 9 with spacing from the inner bell base.

With spacing from the base of the dosing container 6 there is disposed an air-permeable sinter metal plate 10. Arranged above the said plate is the bell 9. The sand 11 in the container 1 bears on the sinter plate 10. In the sand-free chamber 12 between the sinter plate 10 and the base of the dosing container debouches a supply air-line 13 to which an amplifier valve 14 is attached. Via the amplifier valve 14, an air-stream under a pre-determined pressure can be supplied into the dosing container 6. What is concerned may for example be an air quantity of 1.5 l/s at a pressure of 0.5 bar. Disposed in the chamber 12 is an electrical heating system 15 having an outwardly extending current connection 16. The air flowing into the container 1 flows past the heating system 15 and is heated by the latter.

Approximately at the highest point on the container 1 is a pipe elbow 17 having a downwardly facing free aperture 18. To the pipe elbow is connected an air-line 19 which projects through the container 1 and which is guided towards the exterior through the lateral walls of the dosing container 5. There follows the air-line 19 an adjustable throttle 20 which is connected via a line section 21 to the outflow tube 7 ending in the gap between a vehicle wheel 23 and the track or rail.

The dosing device according to the invention operates as follows: The flowability of the sand in the container 1 is guaranteed at all times, in the case of a pre-determined grain spectrum, only when the sand in the container is sufficiently dry and loosened-up.

In order that on braking of the vehicle where required sanding promoting the braking can be cut-in with a high degree of operational reliability, it is advantageous prior to sanding to effect constrained aeration of the sand supply container and as far as possible all air and sand conveying lines with air heated by the heating system 12, without at the same time sand conveying already being initiated out of the container. Thereby, the sand is, prior to initiation of sanding to be adequately aerated or loosened up and dried and prepared for flow-away over the bell and the outlet tube.

Such constrained aeration of the sand supply container, together with the flanged-on dosing container, can be achieved with a wide opening cross-section of throttle 20. Thereby, the flowability of the sand can already be considerably increased by an intensive air-stream in opposition to force of gravity. The design and arrangement of the bell 9, of the exhaust air-line 17, 18, 19 and of the exhaust pipe 7 under the bell are so selected and adapted to each other that in the case of a given sand having a pre-determined grain spectrum, the air-stream supplied under constant pressure via the feed air-line is not yet adequate for conveying the sand over the bell into the discharge tube 7 oppositely relative to force of gravity. However, there is then required only a small degree of throttling of the open cross-section of the throttle 20 in the exhaust air-line 19, for initiating sand delivery. The narrower the throttle cross-section is adjusted to be, the greater is the sand delivery per unit time.

For achieving a high degree of operational reliability of the dosing device according to the invention it may furthermore be advantageous to aerate the sand supply container continuously or at least periodically at a lower pressure in the supply air-line and with the heating cut-in. For this purpose, it is then advantageous to so design the amplifier valve 14 that it can be changed-over from a lower pressure to a high pressure adequate for sand delivery.

The discharge air-line 7 with the throttle 20 may be so designed that also in the case of the widest throttle cross-section, there is still achieved in the container a positive pressure of approximately 0.01 to 0.05 bar. Thereby, inflow of moist air, due to lack of fluid- tightness in the container, is reliably prevented.

The heating 12 serves for heating the supplied air, with which drying of the sand is accelerated or moistening of the sand by external influences is more satisfactorily prevented.

Moistening of the sand by moist air can also be prevented by connecting in the supply air-line 13 a replaceable filter impeding the humidity of the through-flow air. What is concerned here may also be a granular material, for example silica gel, which may be arranged in the chamber 12 below the air-permeable plate 10.

Furthermore, it may be advantageous if there is mixed with the sand an absorbing material (granular kiesel gel for example).

Figure 2 shows a further example of

embodiment according to the invention. Disposed within the end 1, tapering in conical form, of the sand supply container 2 is a bell 3 having base-side apertures or passages 8 the free cross-sections of which are adjustable for passage of the sand 13 below the bell. Approximately centrally through the housing base 4 projects the upper open end 9 of a sanding tube 10 under the bell 3. Via the sanding tube, the sand is thrown on to the travel track immediately before at least one vehicle wheel (not shown). The depth with which the sanding tube 10 projects into the container 2 under the bell or the spacing of the open tube 9 relative to the bell base 11 is designed to be adjustable.

The base 4 of the container 2 is constituted by a porous, air-permeable plate 12 bearing on the sand 13 below the bell 3. The plate 12 is disposed within a chamber 14 in which a heating system 15 is arranged and which is connected via a branch duct 16 to a pressure air duct 17 coupled with which is a pressure air hose 18. Connected in the duct 17 is a valve 17'.

The pressure air hose 18 is designed here as a heating hose, for which purpose it is provided at its periphery with a heating coil 19. It is clear that the heating coil may additionally or solely surround also the pressure air duct 17.

In the case of the heating systems 15 and 19, what are concerned are preferably electrical resistance heating systems, whereof also only one may be present. From the pressure air-duct 17 there branches-off a tube 20 which extends through an aperture in the container base 4 and extends in the container 2 upwardly to above or in the vicinity of the sand level. The open, upper end 21 of the tube 20 is bent-over downwardly, so that on replenishment of sand being effected in the container no sand is able to enter the tube 20.

Disposed on the bell 3 is a porous, air-permeable cap 22 providing between the outer side of the bell 3 and the cap a sand-free chamber 23 connected via a branch-line 24 to the tube 20. The cap 22 and the plate 12 may be made from a sintered material. The inner walls of the container 2 may be lined with a moisture-absorbing layer.

The air hose is connected to a pressure air source (not shown) for example the main container of a brake installation. The valve 17' may be a fixedly adjustable or preferably controllable throttle valve supplying pre-determined air quantities into the duct 17 from which the branch duct 16 and the tube 20 branch-off. The throttle valve may also be so designed that the air quantities for the two component streams are controllable independently of each other, or that only the air-stream is controllable via the branch duct to the chamber 14.

Via the chamber 14, one of the component air-streams passes, as the main air-stream, through the porous plate 12 on to the sand bearing thereon, conveying it to the sand tube. On exceeding a pre-determined air quantity, a pre-determined sand-air mixture is discharged into the open, upper end 9 of the sanding tube 10. The sand quantity per unit time supplied for discharge is therefore a function of the air throughput quantity.

Via the tube 20, the second component air-stream passes, as subsidiary stream, to above or near the level of the sand supply and builds-up there, in the case of a container which is sealed off substantially fluid-tight towards the exterior, a pre-detemined positive pressure which may be somewhat higher than the positive pressure in the container according to Example 1. With this arrangement, the air flows for loosening up the sand through the sand in its flow direction and passes via the passage 8 under the bell in order, together with the first component air-stream supplied by the porous plate, to flow-away into the sanding tube 10.

A portion of the air out of the tube 20 passes via the branch line 24 into the chamber 23 under the porous cap via which the air is blown peripherally into the sand. Thereby, above all, the sand in the zone of the outer bell jacket is loosened-up and supplied as a replenishing flow under the bell.

The flow resistance of a sand aerated via the tube 20 in the container 2 can, in the case of a pre-determined opening cross-section of the passages 8, for example be so high that, in the case of a pre-determined air throughput via the tube 20 and dry sand, as yet no sand is discharged out of the sanding tube, but that therefor also the main air-stream must be cut-in via the porous plate. Due to control of the air quantity discharged into the sand via the porous plate, the sand quantity to be discharged out of the sanding tube can then be controlled. The tube 20 can, in operation, be connected continuously or at pre-determined intervals via the hose to the pressure air source, so as to keep the entire sand supply in the container 2 continuously flowable, the discharge quantity thereof being controlled out of the sanding tube 10 due to the air quantity via the main flow path. For this purpose, it may be advantageous to control the two component air-streams separately of each

other via two separate throttle valves.

The pressure air supplied in the container 2 is heated via the heating systems 15 and/or 19. Due to pressure relief of the heated pressure air in the container, it readily absorbs moisture and is therefore very suitable for drying of the sand.

Due to the fact that the sand supply container is under pressure air, moist fresh air is prevented from entering the container via non-fluid-tight container apertures.

The control possibility of the sanding device according to Figure 2 is not limited to the air quantity control of the two component streams via at least one valve 17'. Additionally, the cross-section of the passage 8 and/or the position of the open tube end 9 of the sanding tube may be controllable under the bell.

In consequence of the fact that both component air-streams flow through the sand in the delivery direction, the dosing device according to the invention can be especially suitable for larger sanding quantities, for example for high velocities or for installations having two sanding tube connections for one wheel in each particular instance. A higher degree of flow force is also necessary due to the sand constriction over the passages 8, and this can be so adjusted that overflow of sand at an undesirable time, soley via the subsidiary air-stream, is reliably prevented.

Figure 3 shows a further sanding device according to the invention. In particular, what is concerned is a sanding device advantageously employing available known sanding devices. In the case of the example, a known sanding device comprises a sand supply container 25 having a bell 26 and a sanding tube guided through the base of the container and projecting to a point below the bell. An ejector nozzle, available in the case of the known sanding device, and via which the air externally of the container is blown into the sanding tube, so as thereby to suck-away sand under the bell into the sanding tube, is halted or optionally employed additionally only for accelerating the sand in the sanding tube. Instead of this, there is applied on the bell a cap 27 made from a porous, air-permeable material and which surrounds a sand-tight chamber 28 connected to which is one end of a tube 29 which, as also the sanding tube, is guided through the container base 30. The container base comprises a porous, air-permeable plate 31, one side of which faces the container interior whereas the other side thereof delimits a chamber 32 sealed off towards the exterior by a sealing plate 33. In the chamber 32, there may be an electrical resistance heating 34.

The other end of the tube 29 externally of the container 25 is connected to a duct 35 which is adapted to be coupled with a pressure air hose 36 connected with a pressure air source (not shown), for example a main air container at 8 bar. The hose 36 may be provided at its connection end with a heating coil 37. In the zone of the passage of the tube 29 through the chamber 32 in the base 31 of the container, it has at least one aperture 38 for branching-off a component stream which, as main stream, passes via the porous plate 31 into the sand below the bell, whereas the other component stream emerges peripherally in the sand mainly for sand loosening, via the air-permeable cap. Both component streams can be jointly set or controlled by a valve designed as an air throttle to correspond to the valve 17' in Figure 2. The mode of operation of these component streams corresponds substantially to that in the example of embodiment according to Figure 2.

It is clear that the component streams can also be controlled separately of each other by two valves. Furthermore, it must be stated that the size relationships selected in the Figures need not be characteristic and do not as yet allow of any conclusions with regard to the flow resistances.

Furthermore, the sanding tube may, to correspond as in Figure 2, be designed to be axially adjustable. Additionally, the opening cross-section 39 between the base and the bell edge may be designed to be adjustable.

For this purpose, there may be attached to the bell edge or rim a collar-form ring 39' which, for adjusting the opening cross-section and therewith for selecting the flow resistance of the sand, projects more or less considerably over the bell edge towards the container base.

Thus, according to the invention due to a subsidiary air-stream of relatively low pressure drop, the sand is initially loosened to such an extent that the sand grains surrounded by air envelopes are taken up by a main air-stream and can be discharged in dosed manner. This has an advantageous effect also for further delivery of the sand through the sand tube up to the point of emergence thereof before the wheels, since the friction resistance of the sand at the walls of the pipe elbow is smaller due to the entrained air, so that the sand flows more rapidly. Thus, known ejector nozzles 40 for accelerating the sand flow-away can, if required, be dispensed with.

Additionally, according to the invention it is possible to dispense, for equalization

of the negative pressure in the sand supply container, in consequence of the suction effect of the known ejector nozzles at the sanding tube, with supplying fresh air through an aperture in the container cover, due to which sand humidity may be considerably increased.

In all of the above described embodiments of the invention, the rate of flow of air in the main flow and in the subsidiary flow are controlled (individually or jointly) as a function of the required rate of supply of sand to the track via the sanding tube.

WHAT WE CLAIM IS:—

1. A method of sanding a track, via a sanding tube arranged to direct sand onto the track in advance of a vehicle wheel, by means of a sanding device and sand-supply container controlled from the vehicle;

in which a controlled quantity of a main supply of air is supplied to the container so as to convey a controllable sand-air mixture from the container to the sanding tube;

a subsidiary flow of air is caused to flow through substantially the entire content of the sand in the container in co-current or counter current relation to the flow of sand towards the entrance to the sanding tube, and generates a controlled super-atmospheric pressure in the container;

after passage of the subsidiary flow of air through the sand in the container, the subsidiary flow is caused to enter the sanding tube;

and the rate of flow of air in the main flow and in the subsidiary flow are controlled as a function of the required rate of supply of sand to the track.

2. A method according to claim 1, in which the subsidiary flow of air through the sand is maintained continuously, or intermittently, in sufficient quantity to maintain the flowability of the sand in the container during non-standing operational periods.

3. A sanding device for sanding a track in advance of a wheel of a vehicle running on the track, the device comprising:

a pressurisable sand supply container;

a sanding tube having an inlet communicating with the interior of the container to receive a supply of an air-sand mixture therefrom;

a pressure control system including an air pressure line communicating with the interior of the sand container;

means for defining a main path of air-flow from said pressure line to said inlet of the sanding tube so as to deliver a sand-air mixture to said inlet;

means for defining a subsidiary path of air-flow through substantially the entire content of sand in the container, in use, in co-current or counter current relation to the general direction of flow of sand towards the inlet of the sanding tube, thereby to render flowable the sand in the container and to generate super-atmospheric pressure therein;

and means for controlling the rate of flow of air along said main path and along said subsidiary path as a function of the required rate of deposition of sand on the track via the sanding tube.

4. A sanding device according to claim 3, in which the upper end of the container has an exhaust air-line which is arranged for taking-up the subsidiary flow of air when the latter flows in counter-current relation through the sand, said exhaust air-line being connected to the sanding tube at a position spaced from the inlet end of the latter.

5. A sanding device according to claim 4, in which an air pressure control device is provided in said exhaust air-line.

6. A sanding device according to claim 3, in which a branch-line of said pressure air-line is arranged to convey a subsidiary flow of air to a sand-tight, air-permeable chamber located in use within the sand in the container and/or to a chamber located in use above the level of sand in the container, the subsidiary stream flowing in use through the entire sand content co-current or counter current relative to the sand and, together with a main stream of air, flowing away via the inlet end of the sanding tube.

7. A sanding device according to claim 6, in which an air pressure control device is provided in a portion of said air pressure line, along which are conveyed in use the main and subsidiary streams, and/or into one or both branch-lines provided for the main and subsidiary streams.

8. A sanding device according to claim 6, in which the sand-tight, air-permeable chamber is delimited by a cap made of filter material located above a bell which shrouds the inlet end of the sanding tube.

9. A sanding device according to any one of claims 6, 7 or 8, in which the air pressure line is connected to the base of the container and, in the zone of its connection to the container, outlet apertures for the main supply of air provided, and in which the air pressure line, beyond the container base, as a branch-line for the subsidiary supply, ends in said sand-tight, air-permeable chamber and/or in the chamber above the sand level.

10. A method according to claim 1 or 2, or a sanding device according to any one of claims 3 to 9, in which a fine-pore filter is provided on which the sand bears

in use, through which air for one or both component streams flows in use.

11. A method or device according to claim 10, in which an electrical resistance heating system is provided in or below the filter and/or in the zone of an air connection for the air pressure line to the container.

12. A method or device according to claim 10 or 11, in which the filter is made from a sintered material.

13. A method or device according to any one of claims 10 to 12, in which the filter comprises a sintered metal plate which constitutes the base of the container through which the sanding tube projects, to which is connected a branch-line of the air pressure line for the main stream.

14. A method or device according to any one of the preceding claims, in which a water-absorbing filter is connected into the air pressure line.

15. A method or device according to any one of the preceding claims, in which the inner walls of the container are lined with a water-absorbing material.

16. A method or device according to any one of the preceding claims, in which the free cross-section between the lower edge of the bell which shrouds the inlet end sanding tube and the bottom of the container is designed to be adjustable for controlling the through-flow resistance to the sand.

17. A method or device according to claim 16, in which the position of the inlet end of the sanding tube below the bell for controlling the inflow resistance of the sand to the sanding tube, is designed to be adjustable.

18. A method or device according to any one of the preceding claims, in which the elements comprising a sand dosing device are arranged within a dosing container which, with its open upper end, is flanged to the open outflow end of the sand supply container.

19. A method according to claim 1 and substantially as hereinbefore described with reference to any one of the embodiments illustrated in the accompanying drawings.

20. A sanding device according to claim 3 and substantially as hereinbefore described with reference to any one of the embodiments illustrated in the accompanying drawings.

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Fig. 1

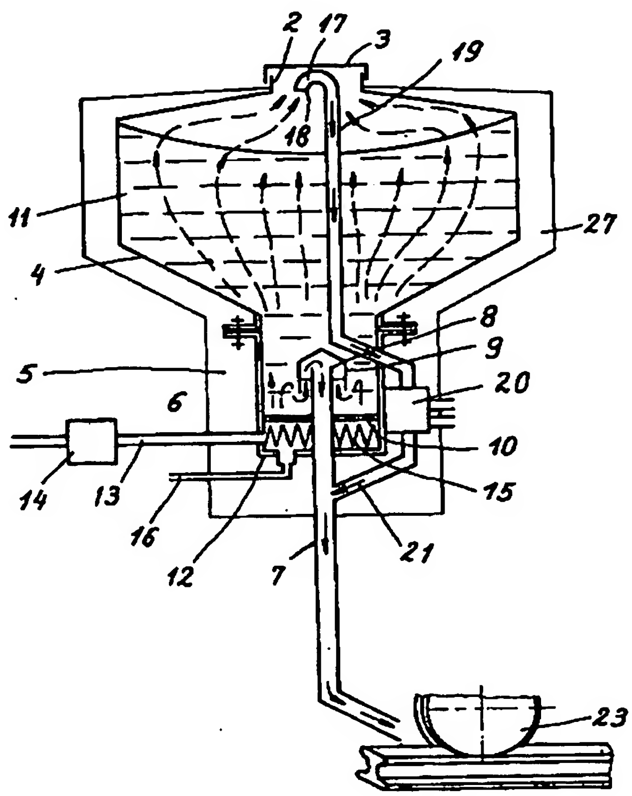

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Fig.2

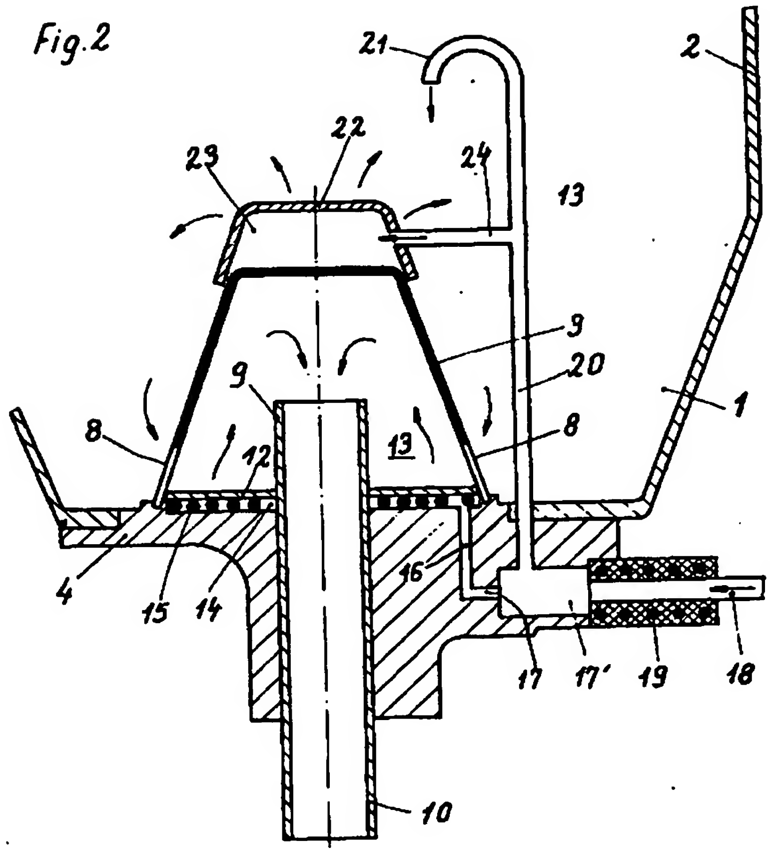

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Fig. 3